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OPERATIVE SURGERY  
AT THE CITY HOSPITAL,

WITH A PRELIMINARY REPORT ON  
THE STUDY OF WOUND INFECTION.

BY

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of Anatomy, College of Physicians and Surgeons.

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By GEORGE EMERSON BREWER, M. D.,

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I AM aware that a simple report of a number of ordinary and comparatively uninteresting surgical cases, occurring in the hospital service of one whose experience has been as limited as my own, offers little of interest to those more advanced in such work. I have, however, been led to make this report for the reason that the cases presented to me several interesting problems for solution, and not a few difficulties to be overcome, and for the additional reason that it may serve to correct an erroneous impression regarding the character of the surgical service of this institution.

In the accompanying table there will be found a record of every patient operated upon or anæsthetized with a view to operation in the surgical division of the City Hospital

\* Read before the Harvard Medical Club, March 28, 1896.

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during a period of six months ending December 31, 1895. This table includes, in addition to a statement of a disease or injury for which the operation was undertaken, a record of the anæsthetic employed, the condition (whether clean or infected) of the wound area before and after the operation, and the general result. An analysis of these facts will form the subject of this communication, together with certain explanatory remarks and brief histories of some of the cases, which presented difficulties and interesting features.

The total number of cases brought to the operating table during the period covered by this report was 151. Of these, 147 received operative treatment, and in 4, after an examination, no operation was undertaken. The cases of operation may be regionally classified as follows: Upon the head, 9; upon the neck, 14; upper extremity, 12; lower extremity, 54; spinal column, 8; pelvic bones, 1; thorax, 1; breast, 1; abdomen, 10; kidney, 1; perinæum, 1; ischio-rectal region, 22; hernias, 13.

*Anæsthesia.*—In 133 cases, ether was used for anæsthesia; in 13, chloroform; in the remaining five cases the histories make no record of an anæsthetic, although cocaine was employed in one or two instances. No death or serious accident occurred as the result of the anæsthetic, although in one patient, to whom chloroform was administered for the removal of tubercular glands of the neck, complete cessation of respiration, with a rapidly declining pulse, occurred and lasted nearly three minutes. Inversion, artificial respiration, and hypodermic stimulation, however, resulted in his recovery, and the operation was completed under ether anæsthesia.

As a very large percentage of the patients admitted into our surgical wards are victims of chronic alcoholism, an annoying tremor occurred in a number of them during the



administration of the anæsthetic. In one instance this was so severe as to merit special mention.

The patient was a muscular and, apparently, healthy middle-aged man. He was etherized for skin-grafting by the Thiersch method. Shortly after the operation was begun a marked tremor of the lower extremities occurred, and extended rapidly to the muscles of the trunk and arms. The shaking became so violent that he had to be held upon the table. As there was considerable lividity of the skin, a large amount of air was given with the ether until he became partly conscious. This, however, did not seem to relieve the tremor, and the anæsthetic was pushed to the most complete intoxication, with dilated pupils and puffing respiration. No cessation, however, took place in the tremor, and the use of the anæsthetic was again discontinued and again resumed. After he became thoroughly anæsthetized the second time, the tremor diminished sufficiently to allow the operation to proceed. A few moments later, and without any apparent cause, the symptoms again appeared with marked severity, and the operation had to be temporarily suspended. This was repeated at intervals, and so delayed our work that an operation which under ordinary circumstances would not have required more than fifteen or twenty minutes was prolonged to considerably more than an hour. No injurious effects, however, followed the etherization.

Of the nine operations upon the head, two were for lacerated wounds of the scalp, which had been neglected and were in an acutely septic condition. These were freely opened, thoroughly cleansed, curetted, partly united, and dressed aseptically. Both patients recovered promptly. In six cases of cellulitis, in which the parts were freely incised, curetted, irrigated, and packed, recovery occurred without incident. Two patients were operated upon for epilepsy, which had apparently followed injuries resulting in depressed fractures of the skull.

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The first case was that of a young man, twenty-six years of age, who had sustained an injury five years before, resulting in a marked depression of the skull near the upper anterior angle of the left parietal bone. Previous to this he had enjoyed perfect health. Following the injury, however, epileptoid convulsions had occurred and increased in frequency to such an extent as to render him a hopeless invalid. As the convulsions frequently began by violent lateral movements of the head to the right, and as the seat of the injury was over the posterior extremity of the first left frontal convolution, by the advice of Dr. E. L. Fisher, attending neurologist to the hospital, who saw the case in consultation, an operation was undertaken. A large omega-shaped incision was made over the motor area, and extending to the posterior margin of the depression. The bone, still adherent to the soft parts, was chiseled through and broken off in the usual manner. At the point of greatest depression of the inner plate of the skull the dura was found to be firmly adherent and thickened. This was separated, and the depressed bone removed by a rongeur forceps. The dura was then opened by a semicircular incision and the motor tract exposed. Nothing abnormal was found. The arm and face centres were verified by electrical stimulation applied directly to this region by Dr. Fisher. The dura was united by fine catgut, the bone replaced, and the soft parts sutured. A sterilized gauze and cotton dressing was applied; the recovery was uneventful. The wound was dressed on the fourth day and half the cutaneous sutures removed; again on the fourteenth day, when the whole wound was found to have united by first intention.

The second case, in which also the operation was done by the advice and with the assistance of Dr. Fisher, was that of a man about fifty years of age, who had been the subject of severe epileptic seizures for many years. He also presented a very deep oblong depression of the skull over the region of the posterior extremity of the left third frontal convolution. Certain peculiarities of speech which were present pointed strongly toward the belief that the depressed bone had pro-

duced more or less injury to the brain of this region. A large omega-shaped incision was made over the motor area and extending to the posterior margin of the depression, a bone flap removed, and the dura incised. The depressed inner table of the skull, lined with very thin adherent dura, was found to have pressed markedly upon the brain at this point, and the underlying convolution was much atrophied. All the depressed bone was cut away, the dura united, the bone flap replaced, and held in position by interrupted skin sutures. No reaction followed the operation, and the wound united throughout by first intention.

Of the fourteen operations on the neck, one was for a large carbuncle, which was cured after extensive crucial incisions. Eight cases of cellulitis, including a typical case of Ludwig's angina, were treated by incision, curetting, and packing with sterilized gauze. Of these, six patients recovered, one was improved, and one was still in the hospital, but nearly well, when I transferred the service to my successor. Five operations for the removal of tuberculous glands were undertaken; two of these were very extensive, and required an incision reaching from the mastoid to the clavicle. All of the patients were discharged well. The spinal accessory nerve was resected in one case for an unusually severe torticollis which had resisted careful and thorough medical treatment. The incision was made over the upper anterior border of the sterno-mastoid muscle, and three quarters of an inch of the nerve resected. The patient was discharged improved.

Of the twelve operations upon the upper extremity, only one deserved special mention. This was a marked deformity of the hand, resulting from a Dupuytren's contraction of the palmar fascia, involving the thumb and little finger, together with complete ankylosis of the phalangeal joints from chronic gout. The difficulties of the case were fully stated to the patient, who begged for any operation which would even partly



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relieve the deformity. The thickened and contracted band of fascia, with the overlying skin, was thoroughly dissected out, and the resulting space filled in with healthy tissue by means of a plastic operation. The wound was found completely united at the first dressing, and, although the ankylosed finger joints remained stiff, as the chief deformity had been relieved, the case may be fairly entered as a recovery.

Of the remaining eleven operations on the upper extremity, four were amputations, two were excisions of necrosed phalanges, three were for wounds, and two for cellulitis. In all of these recovery took place.

Of the fifty-four operations on the lower extremity, there were eight amputations, with six recoveries, one death, and one convalescent still in the hospital.

The fatal case was that of an extremely old and debilitated woman with diabetes and chronic nephritis. She was transferred from one of the other hospitals after an amputation of one of her toes, presumably for diabetic gangrene. The wound was acutely septic, and a rapidly increasing gangrene of the foot occurred. An amputation of the leg was proposed as the only chance of saving the patient's life, and was performed at the request of her husband. Death resulted at the end of a week, from uræmia. The wound had united by first intention.

One extensive and acutely septic lacerated wound of the leg, also transferred to our wards from another hospital, was cleaned and dressed under ether, without improvement, but later the patient submitted to an amputation. Twelve cases of abscess or minor wounds were submitted to operative treatment, with ten recoveries, and two (extensive burrowing of pus from chronic bone disease) in which no improvement followed. There were two cases of necrosis of the tibia; one patient is still in the hospital; the other was not improved by curetting, and refused fur-



ther operative treatment. One case of extensive necrosis of the tarsus was unimproved as the result of a partial operation, but later the patient made a rapid recovery after amputation of the leg. Two hæmatomata were opened and sutured, three excisions of the metatarso phalangeal joint were made, one ingrowing toenail was removed, two deformities from vicious union were refractured, all with excellent results. One ununited fracture was wired, the patient being now convalescent in the hospital. The adhesions in two ankylosed joints were broken up, with one recovery and one patient still in the hospital. One excision of the hip was performed for tuberculous disease, which had been treated for several months by rest and extension, without improvement. The patient died at the end of seven weeks from general tuberculosis. Twelve ulcers of the leg were treated, ten by Thiersch graft, two by curetting, with eleven recoveries and one improved. Three cases of varicose veins were treated by excision. One of these was very extensive, requiring on both legs the excision of eleven venous sections; all of the patients promptly recovered. The knee joint was opened three times, once for septic synovitis, once for the removal of a dislocated semilunar cartilage, and once for exploration. All of the patients recovered with good motion.

Of the eight patients operated upon for disease of the spine, two excisions of the coccyx for obstinate coxalgia recovered, two tuberculous abscesses were opened and drained with substantial improvement. One tuberculous abscess was injected with iodoform emulsion and completely healed. Another treated in the same manner was not improved.

In the seventh case of this series the patient was transferred from one of the medical wards with the diagnosis of a probable new growth pressing upon the mid-dorsal region of the cord. He was afterward seen in consultation by one of

the attending neurologists of the hospital, who advised an exploratory laminectomy. As the outlook was not encouraging, an operation was only undertaken after a written request from the patient, in which he stated that he was well aware of the risks and unfavorable prognosis. The operation demonstrated an absence of new growth, but the presence of a thickened dura, due to caries of the body of the fifth dorsal vertebra. The patient died four weeks later without improvement in his symptoms other than a complete cessation of the painful muscular contractions which had been present up to the time of the interference.

The last case of this series was also a fatal case. My attention was urgently called to the patient by the house surgeon at my first visit to the hospital. She had been suffering from chills, high fever, and profuse sweating ever since her admission. There was a large retroperitoneal collection of pus in the right flank, which was slowly discharging through a minute opening. As the patient could speak no English, and as no history could be obtained, it was thought that we had to do with a circumrenal suppuration of long standing. An exploratory operation revealed the presence of two necrosed vertebral bodies lying free in the enormous abscess cavity. These were removed and the wound was thoroughly irrigated and packed. Marked improvement followed the operation for a few days, but the patient died two weeks later. The autopsy showed pulmonary tuberculosis, chronic nephritis, and amyloid degeneration of the organs.

A case of fracture of the pelvis, with extensive wound of the bladder, was transferred to our wards with the patient in a profoundly septic condition. He had been under treatment at one of the other hospitals for a week or more, and at his entrance presented a large, foul suprapubic wound leading down to the lacerated bladder. At the bottom of this wound was found the inverted median segment of the broken horizontal ramus of the left pubic bone, which was violently pressed backward into the bladder wound at each movement of the patient's body. He was delirious, with fever, dry tongue, and great prostration. Over the chest and abdo-

men were a large number of septic cutaneous ulcers resembling chancreoids. Although the condition of the patient seemed hopeless, he was etherized, the wound and abdomen were disinfected as thoroughly as possible, the bones were brought into position and wired, the septic ulcers were curetted, the bladder and suprapubic wound were thoroughly packed, and the trunk and legs were surrounded by a plaster-of-Paris cast. A special nurse was assigned to him, and one of the house staff was in almost constant attendance, changing the dressing as often as ten or twelve times a day. In spite of our efforts, he rapidly failed, and died in about ten days, of general sepsis.

Of the operations on the trunk, in five, for wounds and sinuses of the abdominal wall, the patients recovered. One breast was successfully amputated for chronic suppuration; a portion of the first rib was excised for caries, with recovery. Two attempts were made to close a large cæcal fistula in the same patient without success. Death followed an attempt to close an old inguinal colotomy wound. The abdomen was not opened; the operation simply consisted in freshening and suturing the edges of the fistula. The patient did well for several days, when the wound parted; later she had symptoms of uræmia, and died in about two weeks without fever or abdominal symptoms. No autopsy could be obtained. Two laparotomies were performed during my service. In one, for exploration, the patient recovered without incident. In one, for gastro-enterostomy, the patient died on the sixth day after four days of normal temperature and pulse. The autopsy showed primary union of abdominal wound, an absolutely aseptic peritoneal cavity, and a perfect anastomosis. The specimen from this case, together with the history, was presented before the Surgical Section of the Academy of Medicine at the February meeting.

Twenty-two operations were performed on the ischio-rectal region. Of these, six were for hæmorrhoids, ten for



ischio-rectal abscess, and six for fistula. All the patients were discharged well.

The only case in which an operation upon the kidney was undertaken was one transferred from the gynæcological service of the hospital.

The patient, a young woman, about twenty years of age, was suffering from uretero-vaginal fistula, the result of a vaginal hysterectomy. Some months after her original operation an unsuccessful attempt was made to implant the divided ureter into the posterior wall of the bladder. As her infirmity precluded the possibility of her resuming her work as a domestic servant, nephrectomy was proposed as the only procedure which would offer hope of permanent relief. This was readily accepted by the patient after a candid statement of the dangers of the operation. She was accordingly etherized, and an attempt made to catheterize the ureters, with a view of confirming the diagnosis. This was unsuccessful, owing to the depression of the base of the bladder following the removal of the uterus. An incision was made into the right lumbar region and the kidney exposed and drawn into the wound. The ureter was then seized and injected with a solution of methyl blue, which promptly appeared at its vaginal opening. The pedicle was ligated by means of four heavy braided silk ligatures, the wound partly closed, and packed with sterilized gauze. The patient did well until the fourth day, when a small collection of pus was found in the neighborhood of the buried cut end of the ureter (presumably due to my carelessness in failing to thoroughly cauterize the stump). This was evacuated and the small cavity packed, and she made a rapid and satisfactory recovery. Six weeks after the operation, and after the practical healing of the wound, she suddenly exhibited symptoms of acute uræmia, and her life was only saved by the extreme care and watchful personal attention of Dr. H. B. Deady, my house surgeon. Three months after the operation she was discharged well.

Twelve operations for hernia occurred during the period covered by this report. Of these, one was for the relief of strangulation, and in eleven the Bassini operation for radical cure was performed.

In the case in which the operation for the relief of strangulated hernia was undertaken, the patient was admitted to the service early in September, suffering from an easily reducible right inguinal protrusion. He requested an operation, but this was refused, as he was found to be suffering from chronic nephritis, uræmia, and alcoholism. He remained under observation in the hospital for nearly three months, but at no time did his condition warrant any operative procedure. On December 9th I was hastily summoned, and found him suffering from all the symptoms of strangulation which had existed for some ten hours. His condition was extremely bad; temperature,  $97.5^{\circ}$ ; rapid and feeble pulse; œdema of both lungs. He was told that an operation for the relief of the strangulated gut offered him his only chance, and at his request the operation was quickly performed under ether. A temporary improvement in his condition followed the operation for a day or two, but the uræmic symptoms gradually deepened, and he died on the sixth day. The hernial wound was found, on autopsy, to have united throughout by first intention.

In the eleven cases operated upon by the Bassini method, all of the patients recovered from the operation, and when last seen presented no symptoms of recurrence. In one case death occurred from cerebral thrombosis six weeks after the operation, and after a complete healing of the wound, as demonstrated by an autopsy, a report of which was read before the surgical section of the Academy of Medicine at the December meeting. Only one of these cases deserves special mention.

The patient was a strong and vigorous man, about sixty years of age. He had suffered for twenty years from a pro-

gressively increasing right inguinal hernia. During the last year he had lost his position on account of his infirmity, and entered the hospital in the hope that something could be done to enable him to resume his work. Upon examination, an enormous hernia was discovered, which extended halfway to his knees and measured twenty-two inches in circumference. As it could be reduced to a small size, and as the abdominal ring was comparatively narrow, an operation for its relief was undertaken. When the sac was opened, about twelve feet of small intestine and from one to two pounds of omentum were found within. Six or seven inches of the intestine were firmly adherent to the bottom of the sac and were separated with considerable difficulty. The sac and omentum were ligated with silk, the conjoined tendon was united to Poupart's ligament with kangaroo tendon, and the aponeurosis and skin were sutured with silkworm gut. The first dressing was removed on the eighth day, when the wound was found to have united by first intention. He was kept in bed for six weeks, and has now been up and about for four months, without any sign of recurrence.

The last case of this report was a peculiar and unusually interesting extravasation of urine. The patient, an Italian, thirty-six years of age, was transferred from one of the other hospitals with a diagnosis of "inoperable" carcinoma of the rectum. His condition at entrance was that of profound sepsis, with high fever, delirium, and an extremely weak pulse. Upon examination, the entire ischio-rectal region was markedly bulged outward and indurated, with four or five large gangrenous areas around the margin of the anus. The mucous membrane of the gut was everted, and of a dark purple color. A subcutaneous cellulitis extended for some distance on the inner and posterior aspect of each thigh. The entire perineal region was a mass of boggy induration, which, however, did not extend far into the scrotal tissues. Several small fistulous openings were present, surrounded by areas of grayish ulceration, which might have suggested the diagnosis of carcinoma. Under ether anæsthesia an examination of the urethra revealed the presence of an extensive stricture in the bulbous



region, which admitted with great difficulty the finest filiform guide. Upon this a Gouley tunneled sound was introduced, and an external perineal urethrotomy performed. A large abscess cavity was found surrounding the urethra near the apex of the prostate. This opened downward into the ischio-rectal fossa, which was filled with gangrenous sloughs. Free incisions were made in every direction, and the necrotic tissues thoroughly removed. As the result of this very extensive removal of tissue the rectum lay free in the now empty ischio-rectal fossa, attached only at its upper portion to the pelvic diaphragm. A No. 38 French perineal rubber tube was used to drain the bladder, and the wound thoroughly packed with sterilized gauze. The patient's condition during the last few moments of the operation was extremely critical, and his life was only saved by the most energetic stimulation. He made an uneventful recovery, and the urethra is now free to 32 F. from meatus to bladder.

A recapitulation of the results obtained in this series of 151 cases will show that 118 patients recovered as the result of operative treatment, 8 were improved, 7 not improved, 8 died, 4 were simply examined, and 6 are still in the hospital.

*Study of Wound Infection.*—By far the most interesting feature of my service, however, was the opportunity which it offered of making a more or less systematic study of wound infection and its prevention. It was a matter of considerable surprise to me that methods which, in private practice, had served to render and keep aseptic regions invaded by operative wounds, utterly failed in the surgical wards of the City Hospital. During the month of May forty-three operations were performed. In six of these, the region to be operated upon was presumably in an aseptic condition, and the resulting wounds should have healed by first intention. In all, suppuration occurred; and, although in the remaining thirty-seven cases, which were septic at the

time of operation, in seven asepsis was established, and the resulting wounds were absolutely free from pus, the showing, as regards our technics, was extremely bad. The following is the plan adopted during this period: The patient was brought to the operating table, and the region to be operated upon was scrubbed for three or four minutes with green soap and hot water, a sterilized brush being used. The skin was then douched with ether, and finally with a solution of bichloride of mercury, 1 to 2,000. The patient was then covered with dry sterilized towels. The dressings, gowns, sheets, and gauze sponges were sterilized for one hour in the Arnold sterilizer. The instruments were boiled for half an hour in a one-per-cent. solution of sodium carbonate and then placed in 1-to-40 carbolic. The ligatures and suture material were treated by immersion for half an hour in a 1-to 20 carbolic solution, then boiled for one hour in a 1-to-80 carbolic solution. The operator and all assistants were clothed in sterilized gowns, and their hands prepared by scrubbing with soap and water for three or four minutes and then immersing them in a 1-to-2,000 bichloride solution for about two minutes. Irrigation by a sterilized normal salt solution.

As soon as it became evident that our results were imperfect, an attempt was made to improve our technics. The sources of infection were thought to be in one or more of the following conditions: First, imperfect sterilization of the hands; second, imperfect sterilization of the patient's skin; third, insufficient and loosely applied dressings, allowing infection by patient's hands during convalescence (one patient admitted having scratched his wound on the fourth day under the dressing); fourth, infection from dandruff falling into the wound during operation; fifth, imperfect sterilization of towels and dressings; sixth, imperfect sterilization of ligatures and suture material; seventh,

contamination of the hands or dressings through carelessness; eighth, rough handling of the divided tissues.

The first improvement which was made was in the method of preparing the hands. Sterilized nail cleaners were provided, the hands scrubbed for fully five minutes with at least two changes of water, then immersed in a 1-to-1,000 solution of permanganate of potassium, later in a solution of oxalic acid, and finally, for three minutes, in 1-to-2,000 bichloride solution. This plan was carried out during my entire service, with the exception of a short period when, as a result of two or more rather startling evidences of faulty technique, ten minutes' scrubbing was insisted upon. This, however, was discontinued, as it rendered the hands sore and too rough to be easily cleansed for subsequent operations.

Various methods were introduced of sterilizing the wound area, including the use of the soap poultice and prolonged wet bichloride dressings. The method finally adopted was to have the parts scrubbed for ten minutes the day before the operation, when this was possible, a wet bichloride dressing left on over night, the part scrubbed again the following morning, and a wet bichloride dressing again applied. This was removed on the operating table and the part douched with ether, bichloride, and sterilized salt solutions.

To avoid contamination of the wound by falling dandruff, sterilized gauze caps were provided and worn in every clean case by all who came in contact with the patient. For a period of two weeks or more wet bichloride towels were used around the wound, but later, the dry, freshly sterilized towels were again employed.

As the hospital possessed no suitable apparatus for boiling our ligature and suture material in alcohol under pressure, the following method was adopted. The gut was



scrubbed with soap and water for fifteen or twenty minutes; then immersed for twenty-four hours in ether, for twenty-four hours in absolute alcohol, for twenty-four hours in a 1-to 2,500 solution of biniodide of mercury in chloroform. It was then placed in a 1-to-80 solution of carbolic acid.

These changes, together with several minor improvements regarding the preparation of the operating table, instrument trays, and the clothing of the patient, were gradually introduced during the months of June, September, and October. The handling of the ligatures, suture material, and the dressings was reduced to a minimum, and more care in the treatment of the divided tissues attempted. The results, though much better than at first, were still very imperfect, and after the complete healing, without infection, of two rather extensive operative wounds, in which Van Horn and Ellison sterilized gut was employed, it was thought that our ligature and suture material was at fault. Accordingly, the following plan was adopted, which served also to exclude infection from contaminated hands and dressings. A patient was brought to the operating table for the Bassini operation for hernia. He was prepared in the manner described above. The instruments and dressings were sterilized in the usual way, but the sterilizers brought to the operating room unopened. After disinfecting my hands in the most thorough manner, I had the instrument sterilizer opened, and laid out the few instruments to be used in the trays. I also removed the gauze sponges and placed them in salt solution. The towels were next removed and placed in a sterilized basin. I then had the dressings removed from the wound area and personally re-scrubbed and douched the skin. After again disinfecting my hands, I applied the towels and proceeded to operate without assistance. My house surgeon was prepared and ready to assist, if necessary, but the only service he ren-

dered was to draw upon a long fold of sterilized gauze which was used to retract the spermatic cord during the application of the deep sutures. His hands never came near the wound, and even when the gauze was withdrawn the part in contact with his fingers was cut away. The operation was completed, the wound closed and dressed, without a single person, other than myself, touching it, the instruments, ligatures, or dressings. Van Horn and Ellison gut was used. No reaction followed the operation—first dressing on the fourteenth day, primary union throughout. In this operation, and in many which followed, one of the house staff was detailed as censor, whose duty it was to stand in a position where every step of the operation could be watched, and to instantly condemn any hand, instrument, sponge, or dressing which, by any accident, was brought in contact with unsterilized material. By this means many errors in technique were avoided which would otherwise have passed unnoticed. The next operation was carried out in exactly the same manner, with the exception that one of the house staff assisted. At the third operation, two of the house staff assisted; later, one nurse was admitted, but the same plan carried out in every other respect, which was followed in every clean case during the remainder of my service. As these cases remained under the first dressing for from four to fifteen days, the results were not known until a number of cases had been operated upon. It was found, however, that the second patient, in whose case one of the house staff assisted, showed, during convalescence, signs of suppuration, which, however, did not appear until after the second dressing, and it is not improbable that infection occurred at that time. One other case only showed any sign of infection, and that was one in which some of the hospital gut was used. With these exceptions, every clean case operated upon during the last

month of my service remained aseptic, and in all septic cases in which it was possible to expect a clean wound after operation asepsis was established, with but one exception, and that was a Thiersch grafting in which a very small amount of pus was found under one strip of the rubber tissue, the rest of the wound being perfectly clean.

A glance at the tabulated list of cases, given below, will show that of the one hundred and fifty-one cases, one hundred and six were infected at the time of operation, thirty-eight were clean, and in seven no incision was made. In sixty-four of the infected cases, the conditions were such as to render complete and permanent sterilization of the operative wound wholly out of the question; and, although under rigid cleanliness the patients, as a rule, made rapid and satisfactory recoveries, they all, at times, exhibited evidences of more or less suppuration. In the remaining forty-two patients, who were infected at the time of operation, an attempt was made to render the wounds clean, and to bring about healing by primary union or granulation without suppuration. This succeeded in twenty-eight and failed in fourteen instances. Percentage of success, 66.67.

Of the thirty-eight cases which were presumably clean at the time of operation, twenty-three remained aseptic and fifteen showed evidences of infection. In several of the latter only a minute stitch infection was found, without a rise of temperature, and often with primary union of the wound. They are, however, classed as infected cases, as they demonstrate some error in technics. If we compare the results obtained during the first three months with those occurring during the last three months, when our technique was much more perfect and our assistants better trained, it will be seen that a decided improvement occurred, which I believe to be directly due to our improved methods. Fifteen clean cases were operated upon during the first three

months, of which ten, or sixty-six per cent., suppurated, and five, or thirty-three per cent., remained aseptic. During the last three months, however, of twenty-three clean cases operated upon, five, or twenty-one per cent., only suppurated, and eighteen, or seventy-nine per cent., showed no sign of infection.

As a large proportion of the patients admitted to our wards are in a wretched condition of malnutrition from syphilis, tuberculosis, chronic alcoholism, and insufficient food, it is not surprising that our results should be inferior to those obtained in institutions where the more fortunate classes are treated; for it is a well-known and generally accepted fact that a vigorous and healthy organism can often overcome without local or general reaction an amount of wound infection which would give rise to local suppuration and marked systemic disturbance in one whose vital forces were greatly reduced by disease or dissipation.

While the writer believes that this fact may account for a certain amount of suppuration following operations on clean cases, it by no means can account for the number of infected cases observed during the first few months of this period, as evidenced by the almost perfect results which occurred during the last month of the service as a sequence of our improved technics.

I may say, in conclusion, that it is my purpose to continue these experiments and, if necessary, to inaugurate a series of bacteriological investigations with a view to locating and removing any other source of infection which up to the present may have escaped detection; after which it may be possible to gather some data which may help to solve the question of how much (if any) unavoidable suppuration may be expected in this class of cases.



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Case No.	Anæsthetic.	Patient's condition.	Disease.	Operation.	Result.	Asepsis.
1	.....	Septic.	Cellulitis of shoulder.	Incision and drainage.	Recovery.	
2	Ether.	Septic.	Cellulitis of neck.	Incision and packing.	Recovery.	
3	Ether.	Septic.	Gunshot wound of flank.	Exploratory operation.	Recovery.	
4	Ether.	Septic.	Compound fracture of fingers.	Amputation.	Recovery.	Established.
5	Ether.	Septic.	Cellulitis of leg.	Incision and drainage.	Recovery.	
6	Ether.	Septic.	Artificial anus.	Closure.	Death.	
7	Ether.	Septic.	Compound fracture of finger.	Amputation.	Recovery.	Established.
8	Ether.	Septic.	Tubercular abscess of neck.	Incision and curetting.	Recovery.	
9	Ether.	Aseptic.	Coxalgia.	Excision of coccyx.	Recovery.	Lost.
10	Ether.	Septic.	Ulcer of leg.	Thiersch graft.	Recovery.	Established.
11	Ether.	Septic.	Ulcer of leg.	Thiersch graft.	Recovery.	Established.
12	Ether.	Septic.	Ulcer of leg.	Thiersch graft.	Recovery.	Established.
13	Ether.	Septic.	Necrosis of first rib.	Excision and packing.	Recovery.	
14	Ether.	Septic.	Chronic mastitis.	Amputation of breast.	Recovery.	
15	Ether.	Septic.	Hæmorrhoids.	Ligation and excision.	Recovery.	
16	Ether.	Aseptic.	Tubercular gland of neck.	Excision.	Recovery.	Lost.
17	Ether.	Septic.	Ulcer of leg (2).	Thiersch graft.	Improv'd.	
18	Ether.	Septic.	Cellulitis of scalp.	Incision and packing.	Recovery.	
19	Ether.	Septic.	Ischio-rectal abscess.	Incision and curetting.	Recovery.	
20	Ether.	Aseptic.	Right inguinal hernia.	Bassini operation.	Recovery.	Lost.
21	Ether.	Aseptic.	Adenoma of neck.	Excision.	Recovery.	Lost.
22	Ether.	Septic.	Cellulitis of cheek.	Incision and suture.	Recovery.	Established.
23	Ether.	Septic.	Ingrowing toe-nail.	Excision.	Recovery.	

Case No.	Anæsthetic.	Patient's condition.	Disease.	Operation.	Result.	Asepsis.
24	Ether.	Aseptic.	Torticollis.	Resection of 11th nerve.	Improvement.	Lost.
25	Ether.	Septic.	Fistula in ano.	Incision, curetting and packing.	Recovery.	
26	Ether.	Septic.	Cellulitis of face.	Incision.	Recovery.	
27	Ether.	Aseptic.	Compression myelitis.	Exploratory laminectomy.	Death 4th wk.	Lost.
28	Ether.	Septic.	Sinus of leg.	Incision, curetting and packing.	Recovery.	
29	Ether.	Septic.	Compound fracture of toe.	Amputation.	Recovery.	Established.
30	Ether.	Septic.	Cellulitis of neck.	Incision, curetting and packing.	Recovery.	
31	Ether.	Septic.	Ischio-rectal abscess.	Incision, curetting and packing.	Recovery.	
32	Ether.	Septic.	Ischio-rectal abscess.	Incision, curetting and packing.	Recovery.	
33	Ether.	Septic.	Ischio-rectal abscess.	Incision, curetting and packing.	Recovery.	
34	Ether.	Septic.	Tubercular abscess of neck.	Incision and curetting.	Recovery.	
35	Ether.	Septic.	Ulcer of leg.	Curetting.	Recovery.	
36	Ether.	Septic.	Fistula in ano.	Incision, curetting and packing.	Recovery.	
37	Ether.	Septic.	Hæmorrhoids.	Ligation and excision.	Recovery.	
38	Ether.	.....	Obscure injury of leg.	Examination under ether.	Recovery.	
39	Ether.	Septic.	Tubercular abscess of neck.	Incision, curetting and packing.	Improvement.	
40	Ether.	Septic.	Ischio-rectal abscess.	Incision, curetting and packing.	Recovery.	
41	Ether.	Septic.	Tubercular osteitis of great toe.	Excision.	Recovery.	
42	Ether.	Septic.	Caries of lumbar vertebræ.	Treves's operation; 2 vertebral bodies removed.	Death 2 wks; autopsy, amyloid organs.	

## 22 OPERATIVE SURGERY AT THE CITY HOSPITAL.

Case No.	Anæsthetic.	Patient's condition.	Disease.	Operation.	Result.	Asepsis.
43	Ether.	Septic.	Dorsal caries.	Exploratory incision.	Improvement.	Established.
44	Ether.	Septic.	Lumbar caries; extensive abscess; septic.	Incision and drainage.	Improvement.	
45	Ether.	Septic.	Fistula in ano.	Incision, curetting and packing.	Recovery.	
46	Ether.	Septic.	Cellulitis of neck.	Incision, curetting and packing.	Recovery.	
47	Ether.	Septic.	Cellulitis of axilla.	Incision, curetting and packing.	Recovery.	
48	Ether.	Septic.	Hæmorrhoids.	Clamp and cautery.	Recovery.	
49	Ether.	Septic.	Carbuncle of neck.	Incision, curetting and packing.	Recovery.	
50	Ether.	Septic.	Periostitis of tibia.	Incision, curetting, suture, packing.	Recovery.	
51	Ether.	Septic.	Fistula in ano.	Incision, curetting and packing.	Recovery.	
52	Chloroform.	Septic.	Tubercular abscess of neck.	Incision, curetting and packing.	Recovery.	Established.
53	Ether.	Septic.	Uretero-vaginal fistula.	Nephrectomy.	Recovery.	
54	Ether.	Septic.	Abscess of axilla.	Incision, curetting and packing.	Recovery.	
55	Ether.	Septic.	Infected scalp wound.	Incision and packing.	Recovery.	
56	Ether.	Septic.	Septic synovitis of knee.	Incision and drainage.	Recovery.	
57	Ether.	Septic.	Caries of alveolar process.	Curetting.	Recovery.	
58	Ether.	Septic.	Fistula in ano.	Incision, curetting and packing.	Recovery.	
59	Ether.	Septic.	Ischio-rectal abscess.	Incision, curetting and packing.	Recovery.	
60	Ether.	Septic.	Prepatellar buritis.	Incision, curetting and suture.	Recovery.	
61	Ether.	Aseptic.	Inguinal hernia.	Bassini operation.	Recovery.	Lost.
62	Ether.	Aseptic.	Inguinal hernia.	Bassini operation; died in six weeks from cerebral thrombosis.	Recovery.	Lost.

Case No.	Anæsthetic.	Patient's condition.	Disease.	Operation.	Result.	Asepsis.
63	Ether.	Septic.	Fracture of pelvis; laceration of bladder.	Wiring of bones.	Death.	
64	Ether.	Aseptic.	Metatarso - phalangeal arthritis.	Excision.	Recovery.	Maintained.
65	Ether.	Aseptic.	Metatarso - phalangeal arthritis.	Excision.	Recovery.	Lost.
66	Ether.	Septic.	Tuberculosis of hip.	Excision.	Death.	
67	Ether.	Aseptic.	Inguinal hernia.	Bassini operation.	Recovery.	Maintained.
68	Ether.	Aseptic.	Dislocated semilunar cartilage of knee.	Removal.	Recovery.	Maintained.
69	Ether.	Septic.	Necrosis of tarsus.	Resection and curetting.	Not improv'd.	
70	Ether.	Aseptic.	Necrosis of tarsus.	Amputation of leg.	Recovery.	Maintained.
71	Ether.	Septic.	Cellulitis of leg.	Incision, curetting and packing.	Recovery.	
72	Ether.	Aseptic.	Coxalgia.	Excision of coccyx.	Recovery.	Lost.
73	Ether.	Aseptic.	Inguinal hernia.	Bassini operation.	Recovery.	Maintained.
74	Ether.	Septic.	Old sinus of abdomen.	Curetted.	Recovery.	
75	Ether.	Septic.	Ulcer of leg.	Thiersch graft.	Recovery.	Established.
76	Ether.	Septic.	Ulcer of leg.	Thiersch graft.	Recovery.	Established.
77	Ether.	Septic.	Necrosis of tibia.	Reamputation.	Recovery.	
78	Ether.	Septic.	Old sinus of thigh.	Multiple incisions.	No improvement.	
79	Ether.	Septic.	Ischio-rectal abscess.	Incision, curetting and packing.	Recovery.	
80	Ether.	Septic.	Gangrene of toe.	Amputation first metatarsal.	Recovery.	Established.
81	Ether.	Septic.	Lacerated wound of finger.	Amputation.	Recovery.	Established.



## 24 OPERATIVE SURGERY AT THE CITY HOSPITAL.

Case No.	Anæsthetic.	Patient's condition.	Disease.	Operation.	Result.	Asepsis.
82	Ether.	Septic.	Lacerated wound of leg; septicæmia; extensive cellulitis.	Incisions; removal of tendons; scrubbing and packing.	Not improv'd.	
83	Ether.	Septic.	Fistula in ano.	Incision, curetting and packing.	Recovery.	
84	Chloroform.	Septic.	Sinus from hernia operation.	Stitch removed.	Recovery.	Established.
85	Ether.	Aseptic.	Recurrent synovitis of knee.	Joint opened.	Recovery.	Maintained.
86	Ether.	Septic.	Necrosis of phalanx.	Excision.	Recovery.	
87	Ether.	Septic.	Ischio-rectal abscess.	Incision, curetting and packing.	Recovery.	
88	Ether.	Septic.	Lacerated wound of leg.	Amputation.	Improvement.	
89	Ether.	Aseptic.	Deform. following Pott's fract.	Osteotomy.	Recovery.	Maintained.
90	Ether.	Septic.	Cellulitis of foot.	Incision, curetting and packing.	Recovery.	
91	Ether.	Aseptic.	Adenoma of neck.	Excision.	Recovery.	Maintained.
92	Ether.	Septic.	Hæmorrhoids.	Ligation and excision.	Recovery.	
93	Ether.	Septic.	Hæmorrhoids.	Ligation and excision.	Recovery.	
94	Ether.	Aseptic.	Inguinal hernia.	Bassini operation.	Recovery.	Maintained.
95	Ether.	Aseptic.	Inguinal hernia.	Bassini operation.	Recovery.	Lost.
96	Ether.	Aseptic.	Depressed fracture of skull; epilepsy.	Bone-flap operation; dura opened.	Recovery.	Maintained.
97	Ether.	Aseptic.	Depressed fracture of skull; epilepsy.	Bone-flap operation; dura opened.	Recovery.	Maintained.
98	Ether.	Septic.	Cellulitis of knee.	Incision and packing.	Recovery.	Established.
99	Ether.	Septic.	Ulcer of leg.	Thiersch graft.	Recovery.	Established.
100	Ether.	Septic.	Ulcerating gumma of knee.	Incision, curetting and suture.	Recovery.	Established.
101	Ether.	Septic.	Ischio-rectal abscess.	Incision, curetting and packing.	Recovery.	

Case No.	Anæsthetic.	Pa-tient's condition.	Disease.	* Operation.	Result.	Asep-sis.
102	Ether.	Septic.	Necrosis of phalanx.	Amputation.	Recovery.	Established.
103	Ether.	Aseptic.	Inguinal hernia.	Bassini operation.	Recovery.	Maintained.
104	Ether.	Aseptic.	Ununited fracture of leg.	Resection and wiring.	.....	Lost.
105	Ether.	Septic.	Necrosis of second phalanx.	Excision.	Recovery.	Established.
106	Ether.	Septic.	Cellulitis of shoulder.	Incision, curetting and packing.	Recovery.	
107	Ether.	Aseptic.	Necrosis of thigh.	Amputation.	Recovery.	Maintained.
108	Ether.	Aseptic.	Varicose veins of leg.	Excision.	Recovery.	Lost.
109	Ether.	Septic.	Old cellulitis of thigh.	Incision and curetting.	No improvement.	
110	Chloroform.	Septic.	Lumbar abscess.	Incision, curetting and packing.	Recovery.	
111	Ether.	Aseptic.	Varicose veins of leg.	Excision.	Recovery.	Maintained.
112	Ether.	Aseptic.	Fæcal fistula.	Exploratory laparotomy.	Recovery.	Maintained.
113	Ether.	Septic.	Fæcal fistula.	Extra - peritoneal suture.	No improvement.	
114	Ether.	Septic.	Hæmorrhoids.	Ligation and excision.	Recovery.	
115	Ether.	Septic.	Ulcer of leg.	Curetting.	.....	Established.
116	Chloroform.	Septic.	Cellulitis of foot.	Incision and packing.	Recovery.	Established.
117	Ether.	Septic.	Necrosis of tibia; infection of joint.	Removal of dead bone.	No improvement.	
118	Chloroform.	Septic.	Sinus from stitch.	Removal of suture.	Recovery.	
119	Chloroform.	Septic.	Infected scalp wound.	Curetted and sutured.	Recovery.	Established.
120	Ether.	Aseptic.	Inguinal hernia.	Bassini operation.	Recovery.	Maintained.
121	Ether.	Aseptic.	Inguinal hernia.	Bassini operation.	Recovery.	Lost.
122	Ether.	Septic.	Ulcer of leg.	Thiersch graft.	Recovery.	Established

Case No.	Anæsthetic.	Patient's condition.	Disease.	Operation.	Result.	Asepsis.
123	Chloroform.	Septic.	Abscess of buttock.	Incision, curetting and packing.	Recovery.	Established. Lost.
124	Chloroform.	Septic.	Ludwig's angina.	Incision, curetting and packing.	Recovery.	
125	Ether.	Aseptic.	Inguinal hernia.	Bassini operation.	Recovery.	
126	.....	Septic.	Tubercular abscess.	Injection of iodoform emulsion.		
127	Ether.	Septic.	Fæcal fistula.	Closure and packing.	Not improved.	Established. Maintained.
128	Ether.	Septic.	Necrosis of tibia.	Removal of dead bone.		
129	Ether.	Septic.	Ulcer of leg.	Thiersch graft.	Recovery.	
130	Ether.	Septic.	Ulcer of leg.	Thiersch graft.	Recovery.	
131	Ether.	Aseptic.	Strangulated hernia.	Herniotomy.	Death.	Established. Maintained.
132	Ether.	Aseptic.	Varicose veins of leg.	Excision.	Recovery.	
133	Ether.	Aseptic.	Dupuytren's contraction.	Plastic operation.	Recovery.	
134	Ether.	Aseptic.	Irritable stump.	Amputation of leg.	Recovery.	
135	.....	Aseptic.	Hæmatoma of knee.	Incision and suture.	Recovery.	Established. Maintained.
136	Ether.	Septic.	Cervical abscess.	Incision, curetting and packing.	Recovery.	
137	.....	Aseptic.	Hæmatoma of leg.	Incision and suture.	Recovery.	
138	Ether.	Septic.	Gangrene of foot.	Amputation of leg.	Death.	
139	Ether.	Aseptic.	Carcinoma of pylorus.	Gastro-enterostomy.	Death.	Established. Maintained.
140	Ether.	Septic.	Tubercular abscess of neck.	Incision, curetting and packing.		
141	Ether.	.....	Vicious union of leg.	Refracture and plaster.		
142	Ether.	Septic.	Old cellulitis of leg.	Incision, curetting and packing.		
143	Ether.	Septic.	Ischio-rectal abscess.	Incision, curetting and packing.	Recovery.	Improvement.
144	Ether.	Septic.	Tubercular abscess of neck.	Incision, curetting and packing.		

Case No.	Anæsthetic.	Patient's condition.	Disease.	Operation.	Result.	Asepsis.
145	Ether.	.....	Ankylosis of knee.	Rupture of adhesions.	Improvement.	
146	Chloroform.	.....	Obscure hip injury.	Examination under anæsthetic.		
147	Chloroform.	.....	Ankylosis of both knees.	Examination under anæsthetic.		
148	Chloroform.	.....	Obscure injury of hip.	Examination under anæsthetic.		
149	Ether.	.....	Ankylosis of both hips.	Rupture of adhesions.		
150	Ether.	Septic.	Extravasation of urine.	Perineal section.	Recovery.	
151	Chloroform.	Septic.	Infected wound in abdomen.	Incision and packing.	Recovery.	

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